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Enke

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[54] **INSTALLATION FOR COOLING INTERNAL COMBUSTION ENGINES**

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[51] **Int. Cl.**.....**F01p 7/02,** F01p 5/06

[58] **Field of Search**.....123/41.49, 41.46, 123/41.11, 41.12, 41.65; 416/182, 185, 186, 188; 415/215, 178

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[57] **ABSTRACT**

An installation for cooling internal combustion engines for motor vehicles by means of a fan driven by the internal combustion engine, possibly by way of an engageable and disengageable coupling controlled, for example, as a function of temperature; the cooling installation is arranged between the radiator and the internal combustion engine and utilizes a so-called semi-axial fan with a hub that increases conically in the direction toward the engine and possesses substantially straight blades that rotate within an outer casing ring secured at the radiator or radiator mounting.

15 Claims, 3 Drawing Figures

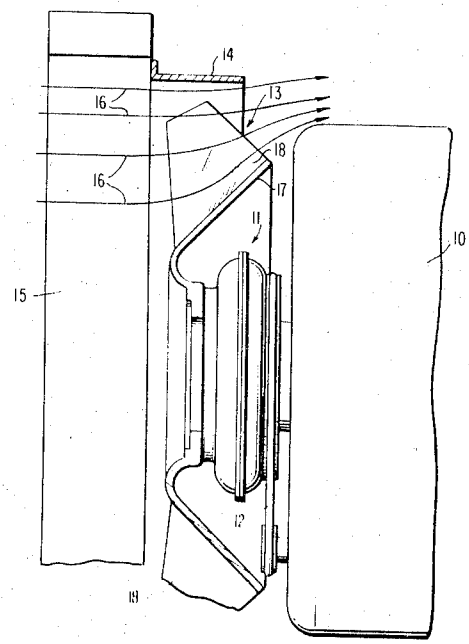


FIG. 1

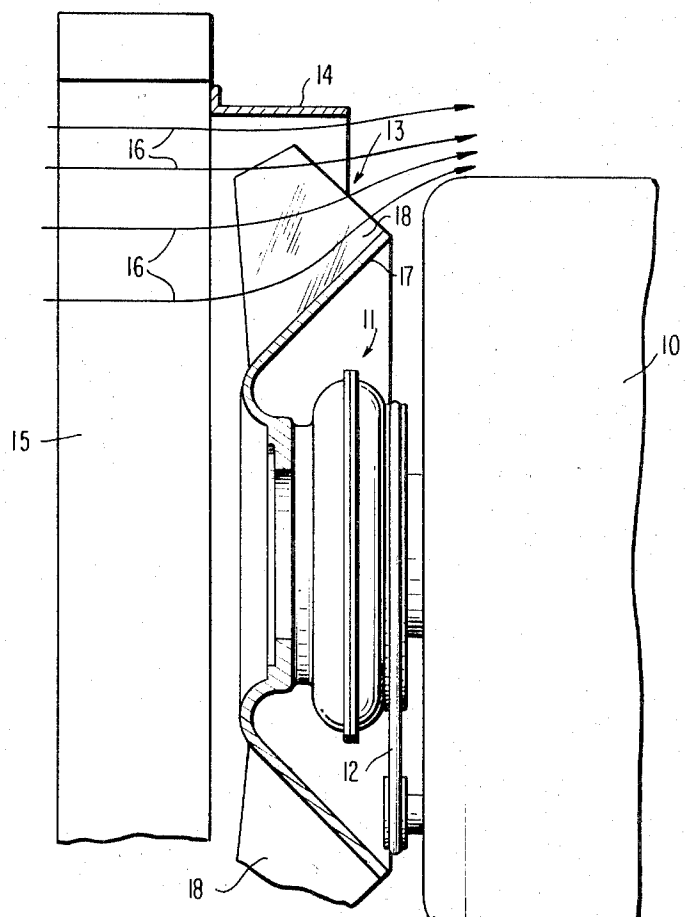
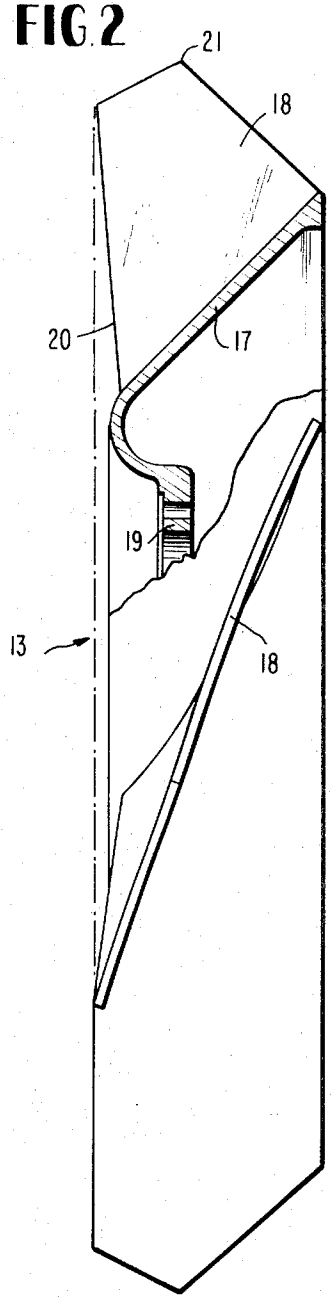


FIG. 2



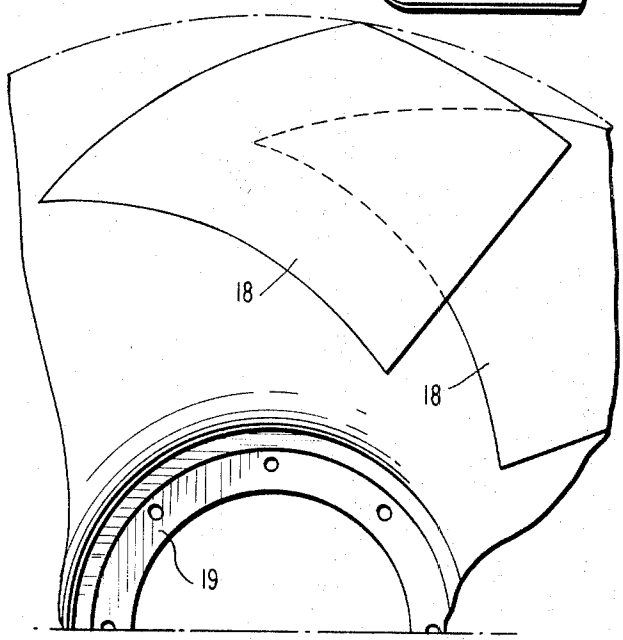


FIG. 3

INSTALLATION FOR COOLING INTERNAL COMBUSTION ENGINES

The present inventin relates to an installation for the cooling of internal combustion engines, with a fan driven by the internal combustion engine possibly by way of an engageable and disengageable coupling, especially by way of a coupling controlled in dependence on the temperature, which is arranged between the radiator and the internal combustion engine.

With the known installations of the aforementioned type, the cooling fan is arranged almost always directly in front of the entire engine block since normally little space is avaiable in the engine space. This has as a consequence with the customarily utilized axial fans that the engine block prevents a free discharge or flowing off of the supplied cooling air. The fan therefore practically supplies only within the area of its blade tips whereas further inwardly hardly an air flow is produced for the reasons described above. Consequently, the entire radiator surface which exists is utilized only very incompletely.

The present invention is concerned with the task to solve this problem. The present invention solves the underlying problem with the arrangement of the aforementioned type by the use of a so-called half- or semi-axial fan with a conical hub strongly increasing in the direction toward the engine and with essentially straight blades, which rotates within an outer casing ring or shroud secured at a conventional radiator or radiator mounting.

The installation according to the present invention offers the advantage that on the discharge side the supplied cooling air is now supplied by means of the fan shape as proposed by the present invention into that portion of the engine space, which is kept free from the engine itself. As a result thereof, a considerably improved discharge or outflow and consequently also a better efficiency of the fan will result. The radiator will therefore be utilized considerably more efficiently in its entire cooling surface.

In a preferred embodiment according to the present invention, the hub of the fan rotor has an inclination of about 45° which remains constant over the entire axial blade width. Furthermore, it is proposed in accordance with the present invention that the outer casing ring overlaps or covers the blades in their axial extension to about 60 to 70 percent. The casing ring itself can therefore—as customary—be constructed cylindrically; however, the present invention prefers a solution according to which the casing ring, as seen in the axial cross section, is conically enlarged like the hub in the same direction though more weakly.

A further feature of the present invention resides in that the hub is bent back bulge-shaped at its side facing the radiator, as viewed in cross section, and passes over into a securing flange. With the aid of this securing flange, the hub is then connected with its drive, i.e., possibly with the driven side of the fan coupling. It is additionally proposed that the fan rotor includes approximately 12 blades which—as viewed in the axial direction—partially overlap one another.

Accordingly, it is an object of the present invention to provide an installation for the cooling of motor vehicle internal combustion engines which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in an installation for cooling motor vehicle internal combustion engines which increases the cooling efficiency as well as makes possible an efficient use of the entire radiator.

A further object of the present invention resides in an installation for cooling motor vehicle internal combustion engines which renders more effective the discharge of the cooling air from the cooling fan.

These and other objects, features, and advantages of the present invention will become more apparent from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

FIG. **1** is a schematic side view of the over-all arrangement of the cooling installation according to the present invention;

FIG. **2** is a side elevational view, partially in cross section, of the fan rotor; and

FIG. **3** is a partial end elevational view of the fan rotor indicating the blade form.

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIG. **1**, a fan coupling generally designated by reference numeral **11** of any conventional construction is secured at the engine block **10**, which is driven in a conventional manner by the engine by way of a V-belt **12**. A fan rotor **13** is mounted on the driven side of the fan coupling **11**, which rotates within a casing ring **14** that is secured at the radiator **15** or at the radiator mounting. The fan rotor **13** is constructed as semi-axial fan so that the air flow takes place approximately along the steamlines **16**, i.e., correspondingly displaced toward the outside. Consequently, the engine can no longer impair the free discharge of the cooling air so that, viewed from an over-all point of view, a better flow and, consequently, a better and more effective cooling can be achieved.

The fan rotor **13** has a relatively large spacing from the casing ring **14** in order that its blade tips do not strike the casing ring **14** when the engine carries out relative movements with respect to the radiator.

According to FIG. **2**, the fan rotor includes a strongly conical hub **17** whose diameter increases in the direction toward the engine and which has a constant inclination of about 45° over the entire width of the blades **18**. In the direction toward the radiator, this hub **17** passes over bulge-shaped into an annular flange **19** by means of which it is connected at the fan drive, i.e., with the output of the fan coupling **11**. The blades **18** which number altogether **12**, are constructed essentially rectilinearly. The blades **18** are extended along the front edge **20** thereof toward the tips in the direction toward the radiator. The outer contour of the blades **18** is constructed approximately angularly shaped whereby the blade tip **21** is disposed in front of the center of the entire blade width, i.e., therefore in a direction toward the radiator. As can be readily seen from FIG. **3**, the blades **18**—as viewed from the fan—overlap one another to an extent which is not insignificant.

It should also be mentioned that the casing ring **14** does not cover the blades **18** over the full width thereof but rather approximately to an extent of about 60 to 70

percent in order that the outlet or discharge of the channels formed between the hub and the casing ring as well as the blades does not become excessively narrow in the direction toward the discharge. However, it is also possible to construct the casing ring **14** not cylindrical but possibly conical and more particularly with the same tendency as the hub **17** through with a considerably weaker or lesser inclination.

While I have shown and described only one embodiment in accordance with the present invention, it is understood that the invention is not limited thereto but is susceptible of numerous changes and modifications as known to those skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim is:

1. An installation for cooling a motor vehicle internal combustion engine by means of a fan driven by the internal combustion engine, which is arranged between a radiator means and the internal combustion engine, characterized in that the fan is a semi-axial fan which includes a conical hub strongly increasing in the direction toward the engine and essentially rectilinear blade means rotating within an external casing means secured at the radiator means.

2. An installation according to claim **1**, characterized in that the fan is driven from the internal combustion engine by way of an engageable and disengageable coupling means.

3. An installation according to claim **2**, characterized in that the coupling means is controlled as a function of temperature.

4. An installation according to claim **1**, characterized in that the outer casing ring means is secured at the radiator support.

5. An installation according to claim **1**, characterized in that the hub has an inclination of about 45° which remains substantially constant over the entire axial blade width.

6. An installation according to claim **5**, characterized in that the outer casing means covers the blade means in their axial dimension approximately to about 60 to 70 percent.

7. An installation according to claim **6**, characterized in that the casing means, as viewed in axial cross section, increases conically in the same direction as the fan hub though with a lesser conicity.

8. An installation according to claim **7**, characterized in that the hub at its side facing the radiator—as viewed in cross section—is bent back bulge-shaped and passes over into a securing flange.

9. An installation according to claim **8**, characterized by the use of approximately 12 blade means which partially overlap one another as viewed in the axial direction.

10. An installation according to claim **9**, characterized in that the fan is driven from the internal combustion engine by way of an engageable and disengageable coupling means.

11. An installation according to claim **10**, characterized in that the coupling means is controlled as a function of temperature.

12. An installation according to claim **1**, characterized in that outer casing means covers the blade means in their axial dimension approximately to about 60 to 70 percent.

13. An installation according to claim **12**, characterized in that the casing means, as viewed in axial cross section, increases conically in the same direction as the fan hub though with a lesser conicity.

14. An installation according to claim **1**, characterized in that the hub at its side facing the radiator—as viewed in cross section—is bent back bulge-shaped and passes over into a securing flange.

15. An installation according to claim **1**, characterized by the use of approximately 12 blade means which partially overlap one another as viewed in the axial direction.

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